APPLICATION FOR UNITED STATES LETTERS PATENT

of

David Vinson
10264 Richwood Drive
Cupertino, CA 95014

Yancy Chen
649 Gindon Drive
Campbell, CA 95008

for

WIRELESS CONTENT PLAYER FOR A VEHICLE

IP Administration
Legal Department, M/S 35
HEWLETT-PACKARD COMPANY
P.O. Box 272400
Fort Collins, CO 80527-2400

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WIRELESS CONTENT PLAYER FOR A VEHICLE

TECHNICAL FIELD

[001] The present application relates generally to audio-video playing devices or players, and more specifically to audio-video players for vehicles.

BACKGROUND OF THE INVENTION

[002] For many years audio systems for vehicles such as cars have allowed occupants of the vehicle to listen to amplitude modulated (AM) and frequency modulated (FM) broadcasts. In recent years, such audio systems have become increasingly high performance and sophisticated, allowing occupants to listen to AM-FM broadcasts and to listen to audio content from cassette tapes and compact disks (CDs). Many current vehicle audio systems have superior sound quality and more comprehensive functionality than audio systems designed for homes not too many years ago.

[003] A functional block diagram of a typical audio system ***100*** contained in a vehicle ***102*** is shown in **FIG. 1**, and includes a head unit ***104*** for allowing vehicle occupants to control various parameters of the system, such as the volume and source of audio content being played. The head unit ***104*** also typically includes a cassette tape player to allow an occupant to listen to cassette tapes when desired. A trunk unit ***106*** communicates with the head unit ***104*** either through wires interconnecting the two devices or through a wireless link ***108*** as depicted in **FIG. 1**. The trunk unit ***106*** contains various system components such as amplifiers (not shown), and also typically includes players for playing audio files stored on compact disks. In current audio systems ***100***, the trunk unit ***106*** typically includes a CD changer for playing audio files stored on a number of compact disks contained in the changer, and may include an MP3 player for playing audio files stored in MP3 format on compact disks. The trunk unit ***106*** applies audio signals to speakers ***110*** to play the audio content selected by an occupant via the head unit ***104***.

[004] The conventional audio system ***100*** includes removable optical disks typically in the form of compact disks for storing audio content such as MP3 files or conventional compact disk audio files. Each disk can hold only a relatively small amount of data and in turn a relatively small number of audio files, limiting the audio content that an occupant may listen to without replacing disks in the trunk unit ***106***. While CD changers that can hold hundreds of disks are presently available, these changers are expensive and take up a relatively large amount of space in the trunk or other portion of the vehicle ***102*** containing the trunk unit ***106***. Moreover, even with a CD changer or MP3 player having a relatively large capacity for holding audio content, an occupant must still remember to insert the desired disks into the CD changer or MP3 player in order to have the content available. A danger of having all these compact disks in the vehicle ***102*** is that the disks can get lost, stolen, or damaged.

[005] In the audio system ***100***, the head unit ***104*** communicates with the trunk unit ***106*** through the wireless link ***108*** as previously mentioned. In some audio systems ***100***, the trunk unit ***106*** communicates an FM signal that is received by the head unit ***104***. This is common where the CD changer in the trunk unit ***106*** is not factory installed but the head unit ***104*** is factory installed, and allows an occupant to add an aftermarket CD changer to his system ***100*** and thereby increase the number of compact disks that can be played at any given time. This approach sacrifices sound quality, however, since the quality an audio signal that may be generated from the FM signal including the encoded digital data from the CD is less than the quality of an audio signal that may be generated by directly using the digital data contained on the CD, as will be understood by those skilled in the art.

[006] It should also be noted that current audio systems ***100*** play only audio files, as the name of the systems imply, and do not provide any functionality for processing any type of content other than audio content, such as video, photographic, or textual content. Moreover, current audio systems do not provide functionality for recording desired content and then playing that recorded content at a later time. In the present description, the terms "content" or "digital content"

denote any type of information available on the Internet or other computer network, such as audio, video, graphics, text, and so on, and may alternately be referred to as a type of file (*e.g.*, an audio content file or audio file) or merely as content (*e.g.*, audio content or audio digital content) in the present description.

[007] There is a need for a system and method of easily providing an occupant of a vehicle with large amounts of various types of content.

SUMMARY OF THE INVENTION

[008] According to one aspect of the present invention, a digital media player includes a mass storage device coupled to control circuitry. The player receives wired digital content from a home network, broadcast signals containing encoded broadcast content, and occupant inputs indicating broadcast digital content to be stored on the mass storage device. The control circuitry operates in a storage mode to receive wired digital content from the home network and store the received content on the mass storage device. In this mode, the control circuitry also operates in response to occupant inputs to store selected broadcast content on the mass storage device. The control circuitry further operates in a play mode to select content stored on the mass storage device in response to user inputs and to play the selected content. The broadcast signal may be, for example, a broadcast AM or FM signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] **FIG. 1** is a functional block diagram of a vehicle including a conventional vehicle audio system.

[010] **FIG. 2** is a functional block diagram of a digital content system including a digital media player contained in a vehicle and coupled through a wireless link to a home network according to one embodiment of the present invention.

[011] **FIG. 3** is a more detailed functional block diagram illustrating one embodiment of the digital media player of **FIG. 2**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[012] **FIG. 2** is a functional block diagram of a digital content system ***200*** including a digital media player ***202*** contained in a vehicle ***204*** and coupled through a wireless link ***206*** to a home network ***208*** according to one embodiment of the present invention. In operation, various types of content in the form of audio, video, and navigational files, for example, are automatically transferred to the digital media player ***202*** when the player is proximate a wireless access point ***210*** contained in the home network ***208***, and the digital media player is also programmable to record desired AM or FM broadcasts for playback at a later time, as will be explained in more detail below.

[013] In the following description, certain details are set forth in conjunction with the described embodiments of the present invention to provide a sufficient understanding of the invention. One skilled in the art will appreciate, however, that the invention may be practiced without these particular details. Furthermore, one skilled in the art will appreciate that the example embodiments described below do not limit the scope of the present invention, and will also understand that various modifications, equivalents, and combinations of the disclosed embodiments are within the scope of the present invention. Finally, the operation of well known components or conventional techniques have not been shown or described in detail below to avoid unnecessarily obscuring the present invention.

[014] In the digital content system ***200***, the home network ***208*** further includes a router ***212*** coupled to the wireless access point ***210***, which functions as a communications hub coupling the digital media player ***202*** to the router through the communications link ***206***. The wireless access point ***210*** would typically be contained in a garage of a residence where the vehicle ***204*** is parked, or be positioned inside the residence adjacent a parking location of the vehicle. A printer ***212*** and desktop computer ***216*** are also coupled to the router ***212***, along with another wireless access point ***218*** that couples a laptop computer ***220*** to the router through a wireless link ***222***. The router ***212*** operates in a conventional manner to

forward data packets from one device to another, where a device corresponds to any component coupled to the router. For example, the router ***212*** may forward data packets corresponding to a text file to be printed from the laptop computer ***220*** to the printer ***214***. More specifically, the laptop computer ***220*** transfers the data packets through the wireless link ***222*** and wireless access point ***218*** to the router ***212*** which, in turn, forwards the data packets to the printer ***214*** for printing. The router ***212*** also provides the desktop computer ***216*** and laptop computer ***220*** access to the Internet through a cable modem ***224*** coupled to the router in a conventional manner. In this way, either the desktop computer ***216*** or laptop computer ***220*** may access various types of content available on the Internet, such as audio, video, graphics, and text files.

[015] The digital media player ***202*** includes a mass storage device such as a hard disk ***226*** for storing digital content transferred to the player from the home network ***208***. A control panel ***228*** in the digital media player ***202*** receives occupant inputs from an occupant of the vehicle ***204***, and provides the occupant with selected content stored on the hard disk ***226*** in response to the occupant inputs. The control panel ***228*** may include, for example, buttons, knobs, switches, and displays that allow an occupant to provide occupant inputs to select the desired content stored on the hard disk ***226***. The digital media player ***202*** also includes an antenna ***230*** for receiving a broadcast signal, such as an AM/FM broadcast signal. The occupant may program the player ***202*** via the control panel ***228*** to store on the hard disk ***226*** selected broadcast content encoded on a received broadcast signal. For example, the occupant could program the player ***202*** to store on the hard disk ***226*** the broadcast content corresponding to a favorite radio show of his that is broadcast during a work day. The occupant may then use the control panel ***228*** to access the broadcast content stored on the hard disk ***228*** and thereby replay the show on his way home from work that evening or at any later point in time.

[016] In operation, an occupant would typically access digital content on the Internet or other computer network via the desktop computer ***216***, and then download selected "wired digital content" to be transferred to the digital media

player ***202*** onto the desktop computer. In the present description, the term occupant is used to refer to a person using the digital media player ***202*** or desktop computer ***216***, while the term "wired digital content" is used to refer to content from the Internet or other computer network. Alternatively, wired digital content could be automatically transferred to the desktop computer ***216*** based upon profile information entered by the occupant, or content could be automatically selected and transferred to the desktop computer based upon prior content selections by the occupant. As previously mentioned, the selected wired digital content may be any type of content, such as MP3 audio files, video files, or bitmap files corresponding to navigational maps.

[017] Once the selected wired digital content is stored on the desktop computer ***216***, the content is transferred through the router ***212***, wireless access point ***210***, and link ***206*** to the hard disk of the digital media player ***202*** when the player is proximate the wireless access point. The specific event triggering transfer of the content from the desktop computer ***216*** to the digital media player ***202*** may vary. For example, the transfer may be triggered simply by the digital media player ***202*** being proximate the wireless access point ***210***. Thus, whenever the vehicle ***204*** pulls into the garage or is otherwise proximate the wireless access point ***210***, the presence of the player ***202*** is detected, causing the desktop computer ***216*** transfer the appropriate digital content to the hard disk ***226*** in the digital media player ***202***.

[018] In another embodiment, the event triggering transfer of the wired digital content from the desktop computer ***216*** to the digital media player ***202*** is the starting or turning off of the vehicle ***204***. The digital media player ***202*** is proximate the wireless access point ***210*** whenever the vehicle ***204*** pulls into the garage or is otherwise properly positioned. Thus, in one embodiment the wired digital content is transferred to the digital media player ***202*** whenever the vehicle turned off. In this way, whenever the occupant comes home and pulls the vehicle ***204*** into the garage, transfer of wired digital content to the digital media player ***202*** is initiated in response to the vehicle turning off to automatically update the wired digital content stored on hard disk ***226*** of the player. In another embodiment, the transfer of wired

digital content from the desktop computer ***216*** to the player ***202*** is initiated in response to the vehicle ***204*** being started. In still another embodiment, the wired digital content is transferred to the digital media player ***202*** at predetermined times. For example, the vehicle ***204*** will presumably be parked in the garage at, for example, 3:00 AM, and thus at this time wired digital content is automatically transferred to the digital media player ***202***. In any of these embodiments, communication may occur between the player ***202*** and desktop computer ***216*** so that only new wired digital content is transferred to the player. For example, just prior to a transfer commencing, the player ***202*** may send a list of current content files to the computer ***216*** which, in turn, only sends new content files not contained on the list.

[019] The digital content system ***200*** further operates to allow an occupant to store selected broadcast content received by the digital media player ***202*** via the antenna ***230***. The term "broadcast content" is used to refer to content encoded on a broadcast signal and stored directly onto the hard disk ***226*** of the digital media player ***202***. In operation, the occupant uses the control panel ***228*** to select desired broadcast content to be stored onto the hard disk ***226***, typically selecting a station and time at which to start recording such content and a time at which to end recording such content. For example, a favorite show of the occupant may be broadcast by radio station WNPR at 94.9 Mhz on the FM band from 12:00-1:00 PM each weekday. The occupant would then program the station and the start and end times into the digital media player ***202***, and the player would then store on the hard disk ***226*** the an audio file corresponding to this broadcast content. The occupant could then, for example, select this file on his way home from work and listen to his favorite show. Information regarding upcoming programs could also be encoded on the broadcast signal to allow an occupant to select desired broadcast content merely by identifying a desired show. This operational mode of the system ***200*** may be termed a "personal audio recording" (PAR) function, which is analogous to a "personal video recording" (PVR) function provided by services such as TiVo. Moreover, although a radio station is used as an example of a broadcast

content, the broadcast content could be audio and video content broadcast by a television station, or could be any other type of content broadcast over a relatively large geographic area via a wireless network.

[020] **FIG. 3** is a more detailed functional block diagram illustrating one embodiment of the digital media player ***202*** of **FIG. 2**. The digital media player ***202*** includes a wireless communications module ***300*** receives data on the wireless communications link ***206*** and provides the data to the hard disk ***226***. More specifically, the hard disk ***226*** includes a disk controller ***302*** that controls the transfer of data to and from a storage disk ***304*** which stores data, where the storage disk is typically a magnetic disk but may be any suitable mass storage media. The disk controller ***302*** transfers data received from the wireless communications module ***300*** to the hard disk for storage. A processor ***306*** receives content stored on the storage disk ***304*** via the disk controller ***302***, and processes the content to generate digital signals ***308*** corresponding to the stored content. For example, where the content is audio files stored in MP3 format, the processor ***306*** decodes the MP3 files to generate corresponding digital signals ***308***. A digital-to-analog converter ***310*** generates a number of analog audio signals ***312*** in response to the digital signals ***308***, and these analog signals ***312*** are applied to an amplifier or speakers (not shown) to generate audible sounds.

[021] A memory system ***314*** is coupled to the processor ***306*** and includes boot and operating system information contained in FLASH memory ***316*** and includes synchronous dynamic memory (SDRAM) ***318*** for storing data and programs being executed by the processor. A real-time clock ***320*** generates a time that is applied to the processor ***306***, and is used by the processor, for example, in determining when to record broadcast content received by the digital media player ***202***, as previously discussed. The digital media player ***322*** may also include a display ***322*** that the processor ***306*** drives to display video, photographic, text, or other types of visual content stored on the storage disk ***304***. An AM/FM receiver module ***324*** is coupled to an antenna ***326*** to receive broadcast signals ***328***, which in this case correspond to AM/FM broadcast signals. The AM/FM broadcast signals ***328*** are

analog signals, and the receiver module ***324*** demodulates and decodes these analog signals to generate corresponding digital signals ***330***, as will be appreciated by those skilled in the art. When an occupant is listening to a radio station, the digital signals ***330*** are applied to the processor ***306*** which, in turn, processes these signals to generate the digital signals ***308*** and the converter ***310*** generating the audio signals ***312*** responsive to the digital signals ***308***. When the player ***202*** is programmed to record broadcast content contained on the broadcast signal ***328***, the receiver module ***324*** provides the corresponding digital signals ***330*** the disk controller ***302*** which, in turn, provides the signals to the storage disk ***304*** for storage.

[022] The control panel ***228*** is coupled to the receiver module ***324*** to program the module to record desired broadcast content in response to occupant input applied to control inputs ***332***, which may include buttons, switches, and knobs. In response to the control inputs ***332***, the control panel ***228*** applies corresponding electrical signals ***334*** to the receiver module ***324*** to control operation of this module, such as to select the radio station to be listened to and to select the AM or FM band. The control panel ***228*** also generates electrical signals ***336*** in response to control inputs ***332*** and applies these signals to the processor ***306*** to control the selection of content to be played by the digital media player ***202***.

[023] In operation, the digital media player operates in either a storage mode or a play mode. In the storage mode, wired digital content is received by the wireless communications module ***300*** via the link ***206*** and stored on the storage disk ***304*** via the disk controller ***302***. Similarly, an occupant applies control inputs ***332*** to the control panel ***228*** to select desired broadcast content to be stored on the storage disk ***304***, and the receiver module ***324*** applies the digital signals ***330*** corresponding to the desired broadcast content to the disk controller ***302***. The disk controller ***302*** applies the digital signals ***330*** to the storage disk ***304*** for storage to thereby store the selected broadcast content on the storage disk.

[024] In the play mode, an occupant applies control inputs ***332*** to the control panel ***228*** to select the desired content to be played by the player. In response to the

control inputs ***332***, the control panel generates signals ***336*** causing the processor ***306*** to accesses the selected content files stored on the storage disk ***304*** and to thereafter process these selected content files to play the selected content. For example, where the selected content files are audio files the processor ***306*** decodes the files to apply signals ***308*** to the converter ***310*** which, in turn, applies corresponding analog signals ***312*** to speakers (not shown). Where the selected content are video files, the processor ***306*** decodes the files to apply signals ***308*** to the converter ***310*** to generate corresponding audio signals ***312*** and drives the display ***322*** to generate the corresponding video images. In the play mode, the occupant may also select to listen to a real time radio broadcast, in which case the occupant provides the appropriate control inputs ***332*** and the control panel ***228*** applies the corresponding signals ***334*** to the receiver module ***324***. The receiver module ***324*** applies the digital signals ***330*** corresponding to the selected station to the processor ***306***, which processes these signals and provides corresponding signals ***308*** to the converter ***310***.

[025] In the described example embodiments of the present invention, one skilled in the art will understand suitable circuitry for forming the various components described. For example, in the embodiment of the digital media player ***202*** shown in **FIG. 3**, suitable circuitry for forming the components ***300-334*** will be understood by those skilled in the art. The same is true of the home network ***208*** of **FIG. 2**, where each of the described components ***210-224*** is a commercially available component, and the circuitry and operation of such components is well understood by those skilled in the art.

[026] Even though various embodiments of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail and yet remain within the broad principles of the present invention. One skilled in the art will appreciate that the example embodiments described above do not limit the scope of the present invention, and will also understand various modifications, equivalents, and combinations of such

embodiments are within the scope of the present invention. Therefore, the present invention is to be limited only by the appended claims.